

2.0 DESCRIPTION OF THE PROJECT

2.1 OVERVIEW OF THE OROVILLE FACILITIES

The Oroville Facilities include Lake Oroville (the state's second largest reservoir), Oroville Dam, three powerplants (Edward Hyatt Powerplant, Thermalito Diversion Dam Powerplant, Thermalito Pumping-Generating Plant), Thermalito Diversion Dam, the Fish Barrier Dam, the Feather River Fish Hatchery, Thermalito Power Canal, Thermalito Forebay, and the Thermalito Afterbay. The locations of these project features are indicated on Figure 2-1. (Figure 1-1, found in the inside pocket of the report's back cover, provides more detail on the locations of the project facilities and indicates the boundaries of the project area as well.)

The Oroville Facilities are a part of the State Water Project, one of the largest water and power systems in the world. The SWP includes 17 pumping plants, 32 storage facilities (mainly reservoirs and lakes), five hydroelectric powerplants, three pumping-generating plants, and more than 660 miles of canals, tunnels, and pipelines (Figure 2-2). The Oroville Facilities, which are located at the upstream end of the SWP, have the capacity to store over 3.5 million-acre feet of water and account for most of the SWP's water capture and storage. Water released from the Oroville Facilities into the Feather River flows south, joins the Sacramento River, and flows into the Sacramento-San Joaquin Delta. At the north end of the Delta, some of this water is pumped into the North Bay Aqueduct and routed west to provide a supplemental water supply to Solano and Napa counties. The rest of the water from the project flows south through the Delta to the Clifton Court Forebay, a large, shallow reservoir at the Delta's southern edge, where the project's water is collected and stored. From the forebay, the water enters the Banks Pumping Plant, which lifts the water 244 feet up to the Bethany Reservoir. From the Bethany Reservoir, some of the water is routed into the South Bay Aqueduct, which delivers water to Alameda and Santa Clara counties, and the rest is routed into the California Aqueduct, which conveys the water to agricultural and urban users in the San Joaquin Valley, Central Coast, and Southern California. Operation of the SWP requires over 13.7 billion kilowatt-hours of electricity a year to pump deliveries of 4.2 million acre-feet of water. The project's electric power needs are met, in part, by the output of the three powerplants that are a part of the Oroville Facilities.

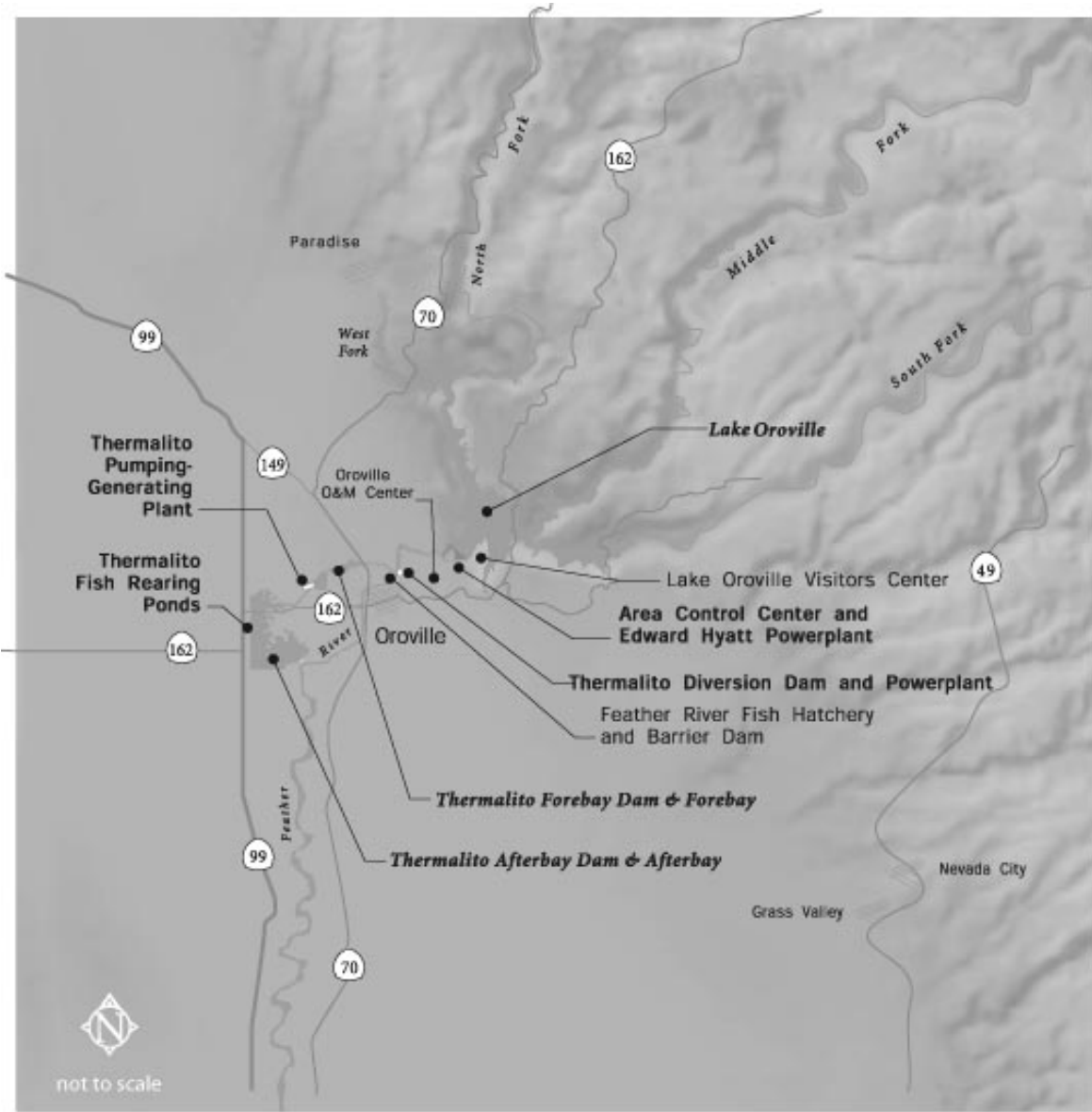


figure 2-1
Lake Oroville and adjacent plants and dams



★ Oroville Project facilities

Figure 2-2 Oroville Facilities and
Other State Water Project Features

2.2 ENGINEERING DESCRIPTION OF THE PROJECT

2.2.1 Oroville Facilities

2.2.1.1 Oroville Dam

Oroville Dam is depicted in Figure 2-3, and Figure 2-4 includes a plan of the dam and surrounding area and a cross-section of the dam structure. Construction of the dam began in 1961 and was completed in 1968. It is a zoned earthfill dam and has an embankment volume of 80,000,000 cubic yards. At 770 feet high, it is the highest earthfill dam in the United States. The crest of the dam is 6,920 feet long, 51 feet wide, and at an elevation of 922 feet.

The spillway, located on the right abutment of the dam, has two separate elements: a controlled gated outlet and an emergency uncontrolled spillway. The gated control structure was designed to permit controlled releases of up to 150,000 cubic feet per second (cfs) into a concrete-lined chute that extends to the river. The emergency uncontrolled spillway is designed so that if the reservoir were to fill above 901 feet, water could flow over the emergency spillway weir and down the undeveloped canyon slope to the river.

2.2.1.2 Lake Oroville

Lake Oroville (Figure 1-1) stores winter and spring runoff that is released into the Feather River, as necessary, for project purposes. Two small embankments, Bidwell Canyon and Parish Camp Saddle dams, complement Oroville Dam in containing Lake Oroville. The reservoir has a storage capacity of 3,538,000 acre-feet and is fed by the North, Middle, and South Forks of the Feather River. Average annual unimpaired runoff into the lake is about 4.2 million acre-feet (maf). The water surface elevation and water surface area at maximum operating storage are 900 feet and 15,810 acres, respectively. The shoreline covers 167 miles at maximum operating storage.



Figure 2-3 Lake Oroville, Dam, and Diversion Pool

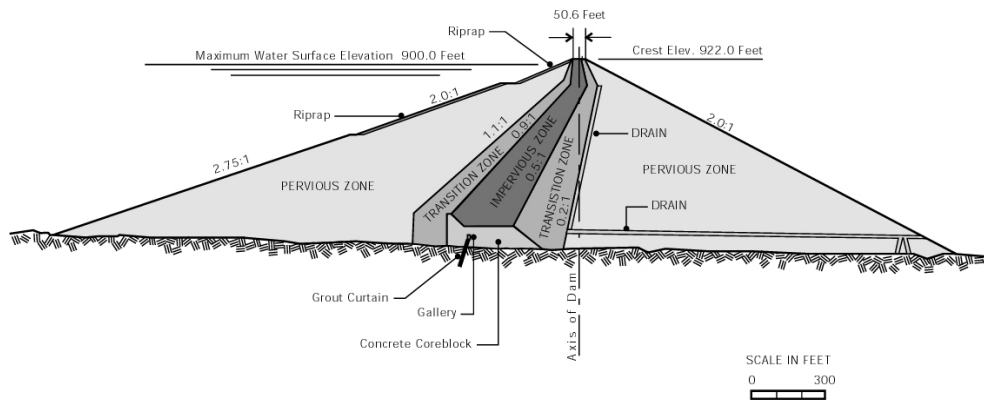
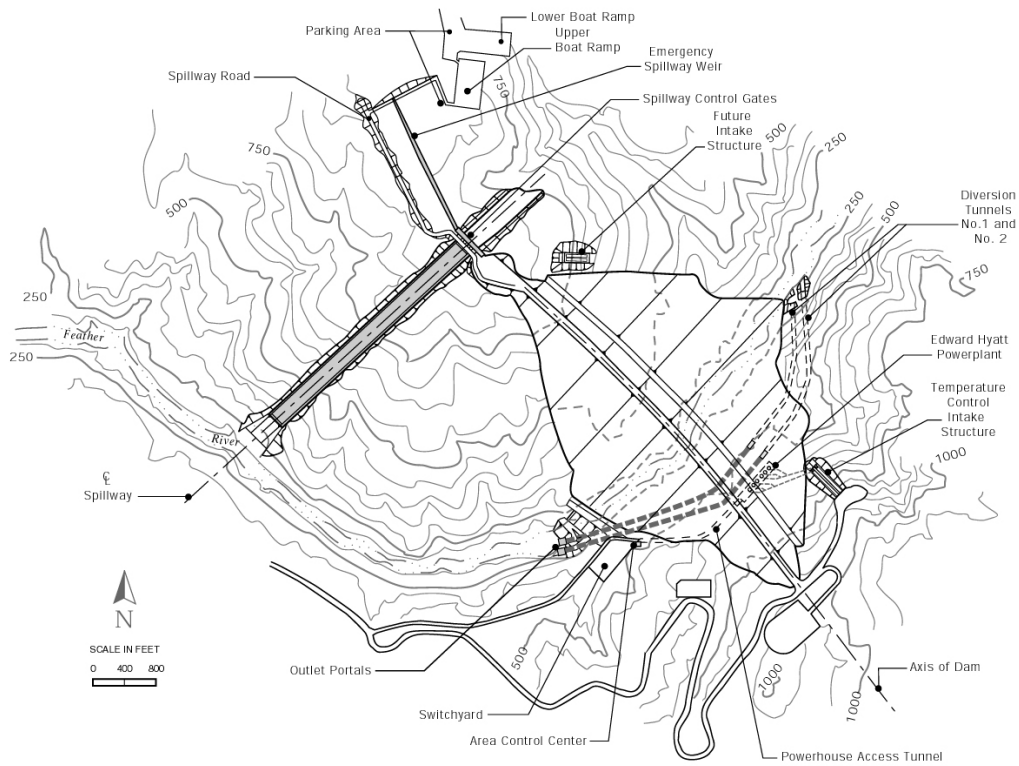


Figure 2-4 Oroville Dam

Edward Hyatt Powerplant

Located in rock in the left abutment near the axis of Oroville Dam, Edward Hyatt Powerplant is an underground, hydroelectric pumping-generating facility (Figure 2-5). Construction of the plant began in 1964 and was completed in 1967.

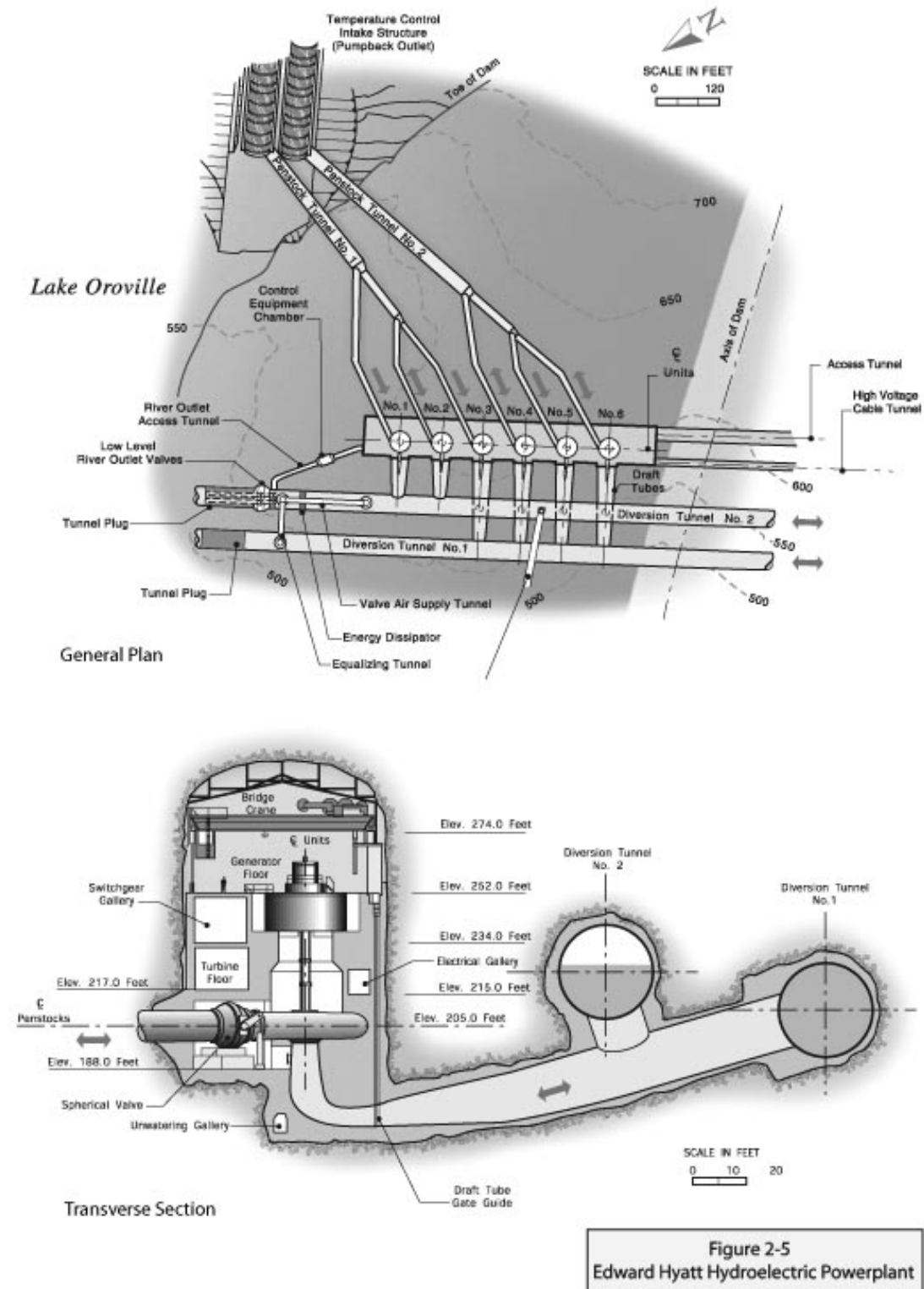
A maximum flow of 17,000 cfs can be released through Edward Hyatt Powerplant. Three of the six units are conventional generators driven by vertical-shaft, Francis-type turbines; the other three are generator/motors coupled to Francis-type, reversible pump turbines. The latter units allow pumped storage operations². The intake structure has an overflow type shutter system that determines the level from which water is drawn.

Table 2-1 summarizes the pumping and generating information for the Edward Hyatt Powerplant.

Table 2-1: Pumping And Generating Information For Edward Hyatt Powerplant

	Pumping	Generating
Installed Capacity	5,610 cfs & 519,000 hp	645 MW & 16,950 cfs
Normal Static Head	500-660 feet	410-676 feet
Design Dynamic Head	592 feet	615 feet
Number of Units	3 pumping/generating	6 (3 generating, 3 pumping/generating)
Unit Size	1,870 cfs & 173,000 hp	3 @ 115 mVA & 2,800 cfs
		3 @ 123 mVA & 2,850 cfs
Penstock Diameter		2 @ 22 feet

² Edward Hyatt Powerplant maximizes the value of power production through a pumped-storage operation where water, released for power in excess of local and downstream requirements, is pumped back into Lake Oroville during off-peak periods and is used for power generation during peak power demands.



2.2.2 Thermalito Diversion Facilities

2.2.2.1 Thermalito Diversion Dam

Approximately four miles downstream of Oroville Dam and Edward Hyatt Powerplant is the Thermalito Diversion Dam (Figures 2-6, 2-7, and 2-8). This facility, which was constructed between 1963 and 1968, consists of a 625-foot-long, concrete gravity dam with a regulated ogee spillway that releases water to the Low Flow Channel of the Feather River. The dam has an embankment volume of 154,000 cubic yards, a height of 143 feet, a crest length of 1,300 feet and an elevation of 233 feet.

The dam has two purposes: (1) it diverts water into the two-mile-long Thermalito Power Canal, which transports it to the Thermalito Pumping-Generating Plant for power generation (Figure 2-6); and (2) it creates a tailwater pool (called Thermalito Diversion Pool) for the Edward Hyatt Powerplant.

2.2.2.2 Thermalito Diversion Pool

The Thermalito Diversion Pool (Figures 2-3, 2-6, and 2-9) acts as a forebay when the Edward Hyatt Powerplant is pumping water back into Lake Oroville. The Diversion Pool holds a maximum of 13,350 acre-feet. The water surface elevation and water surface area at maximum operating storage are 225 feet and 320 acres, respectively. The shoreline covers 10 miles at maximum operating storage.

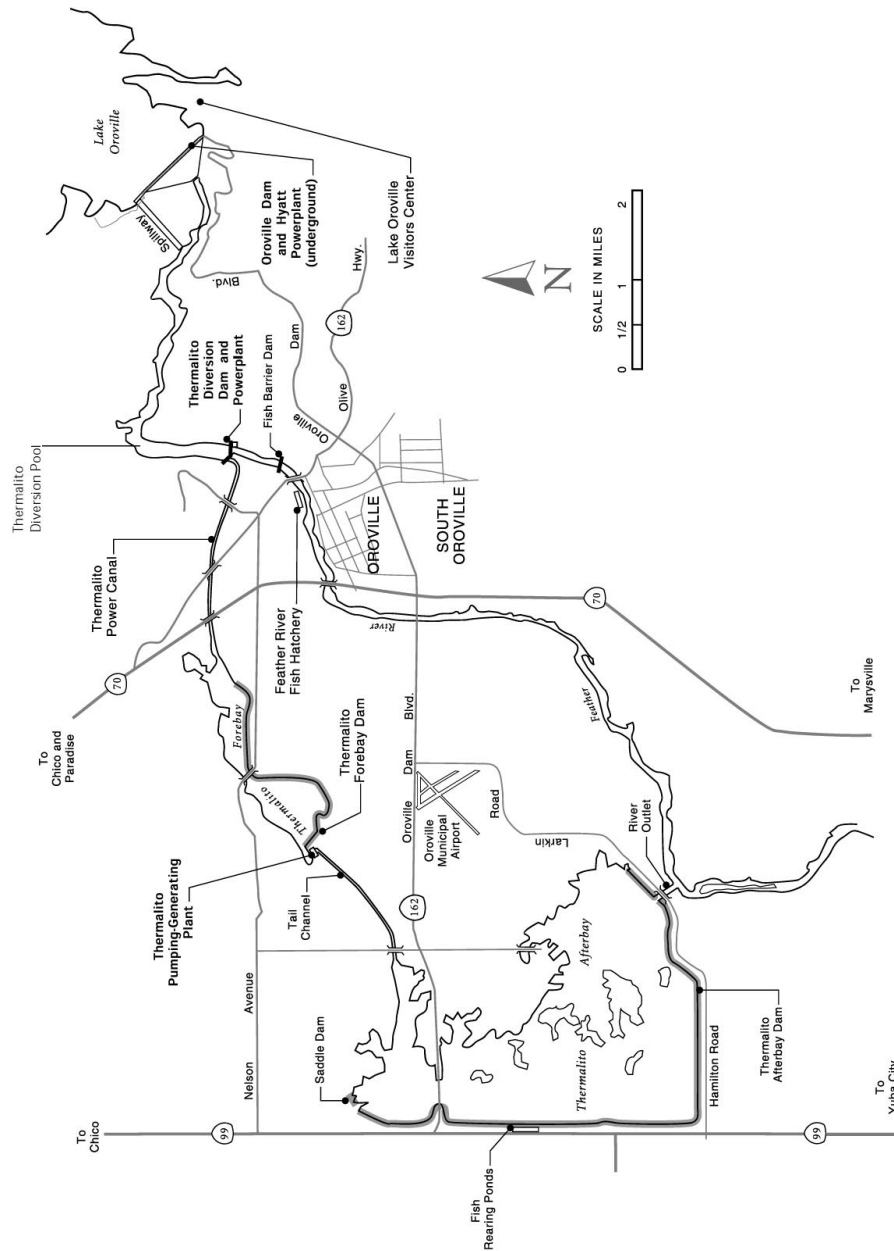


Figure 2-6 Thermalito Facilities



Figure 2-7 Thermalito Diversion Dam and Power Canal

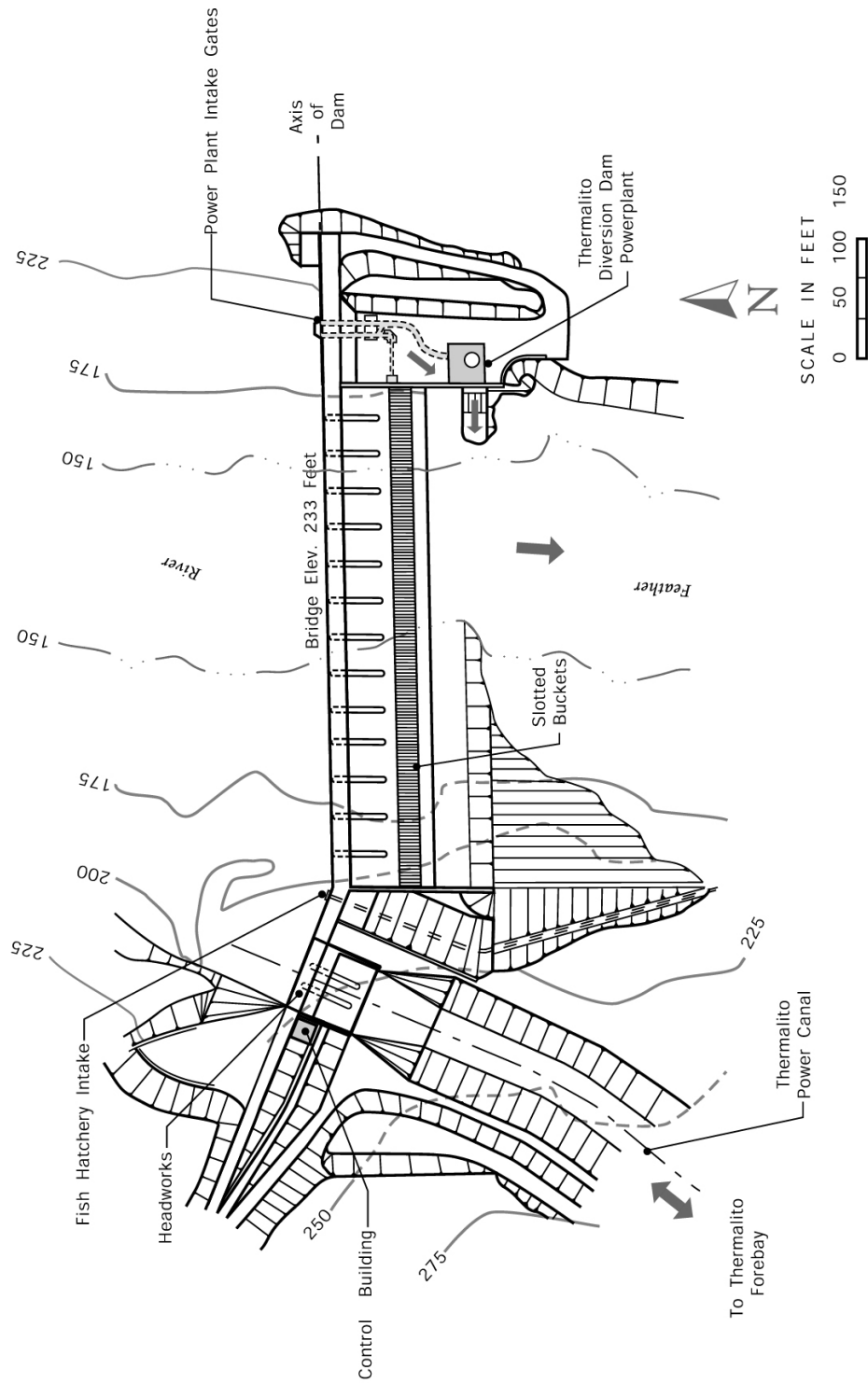


Figure 2-8 Thermalito Diversion Dam
General Plan



2.2.2.3 Thermalito Diversion Dam Powerplant

The Thermalito Diversion Dam Powerplant (Figure 2-10) is on the left abutment of the Thermalito Diversion Dam. It was constructed between 1985 and 1987. The powerplant generates electricity from water released to the Low Flow Section of the Feather River to maintain fish habitat between the Diversion Dam and the Thermalito Afterbay River outlet. It releases a maximum of 615 cfs to the Low Flow Channel of the river. Table 2-2 lists the generating information for the Thermalito Diversion Dam Powerplant.

**Table 2-2: Generating Information for
Thermalito Diversion Dam Powerplant**

Installed Capacity	3 MW & 615 cfs
Normal Static Head	63-77 feet
Design Dynamic Head	67 feet
Number of Units	1
Unit Size	3.3 MVA & 615 cfs
Discharge Lines/Diameter	2 @ 5 feet to 1 @ 7.5 feet

2.2.2.4 Thermalito Power Canal

Thermalito Power Canal (Figures 2-6 and 2-7) hydraulically links the Thermalito Diversion Pool to the Thermalito Forebay and can convey water in either direction between the two facilities. The water in the Power Canal is used for pumping and power generation at the Edward Hyatt Powerplant and Thermalito Pumping-Generating Plant.

The headwork structure for the Thermalito Power Canal is located on the right abutment of the Thermalito Diversion Dam. The Power Canal is a concrete-lined canal 10,000 feet in length. The maximum generating and pumping flows are 16,900 cfs and 9,000 cfs, respectively.

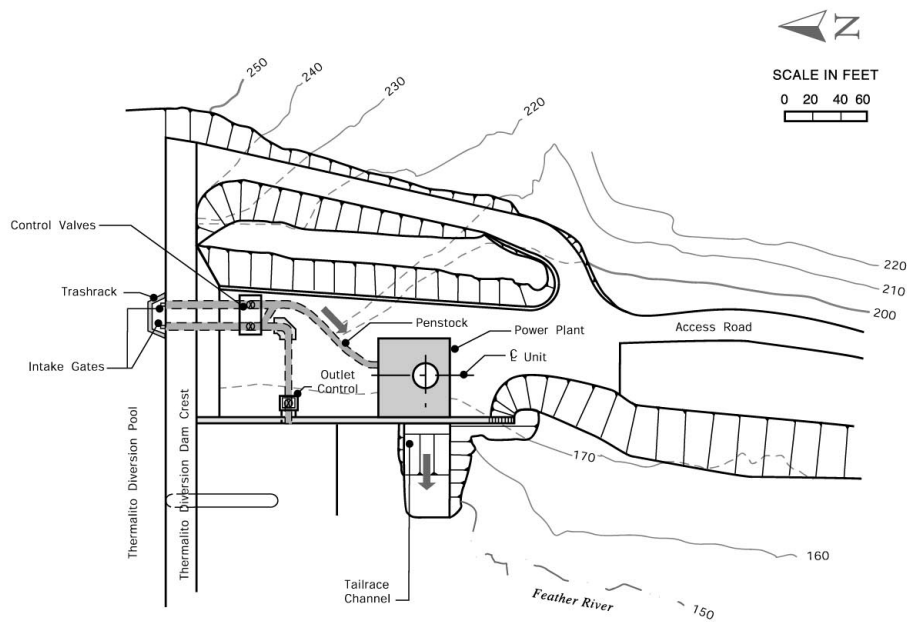
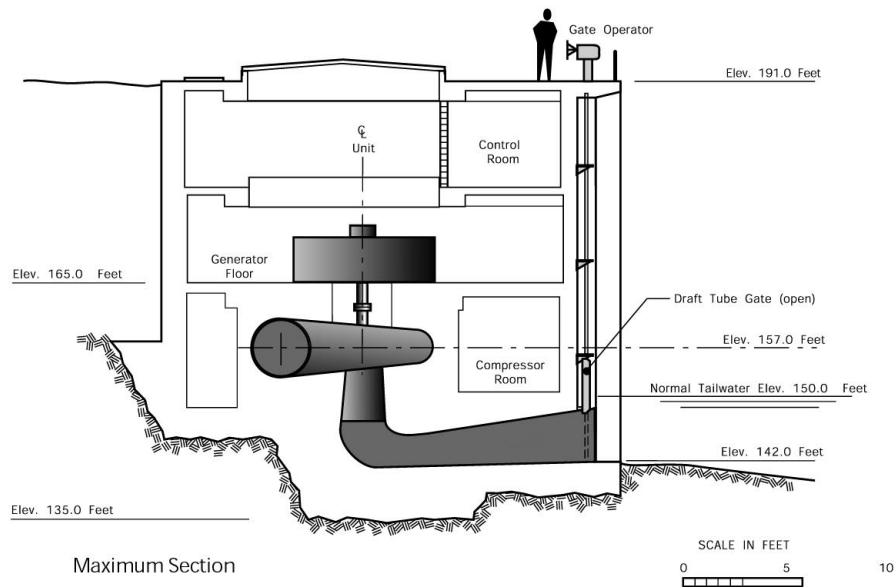


Figure 2-10 Thermalito Diversion Dam Powerplant

2.2.3 Thermalito Forebay Facilities

2.2.3.1 Thermalito Forebay Dam

The Thermalito Forebay Dam (Figures 2-11 and 2-12) was constructed between 1965 and 1968. It is located about four miles west of the City of Oroville. The dam is a homogeneous and zoned earthfill dam. It has an embankment volume of 1,840,000 cubic yards, a height of 91 feet, and a crest length and elevation of 15,900 feet and 231 feet, respectively.

2.2.3.2 Thermalito Forebay

Thermalito Forebay (Figures 2-6, 2-11, and 2-12) is the off-stream regulating reservoir for the Thermalito Pumping-Generating Plant. It is contained by the Thermalito Forebay Dam on the south and east and by Campbell Hills on the north and west. The Forebay has three purposes: (1) it conveys generating and pumping flows between the Thermalito Power Canal and Thermalito Pumping-Generating Plant; (2) it provides regulatory storage and surge damping for the Hyatt-Thermalito power complex; and (3) it serves as a recreational site.

Thermalito Forebay holds a maximum of 11,768 acre-feet of water. The water surface elevation and water surface area at maximum operating storage are 225 feet and 630 acres, respectively. The shoreline covers 10 miles at maximum operating storage.

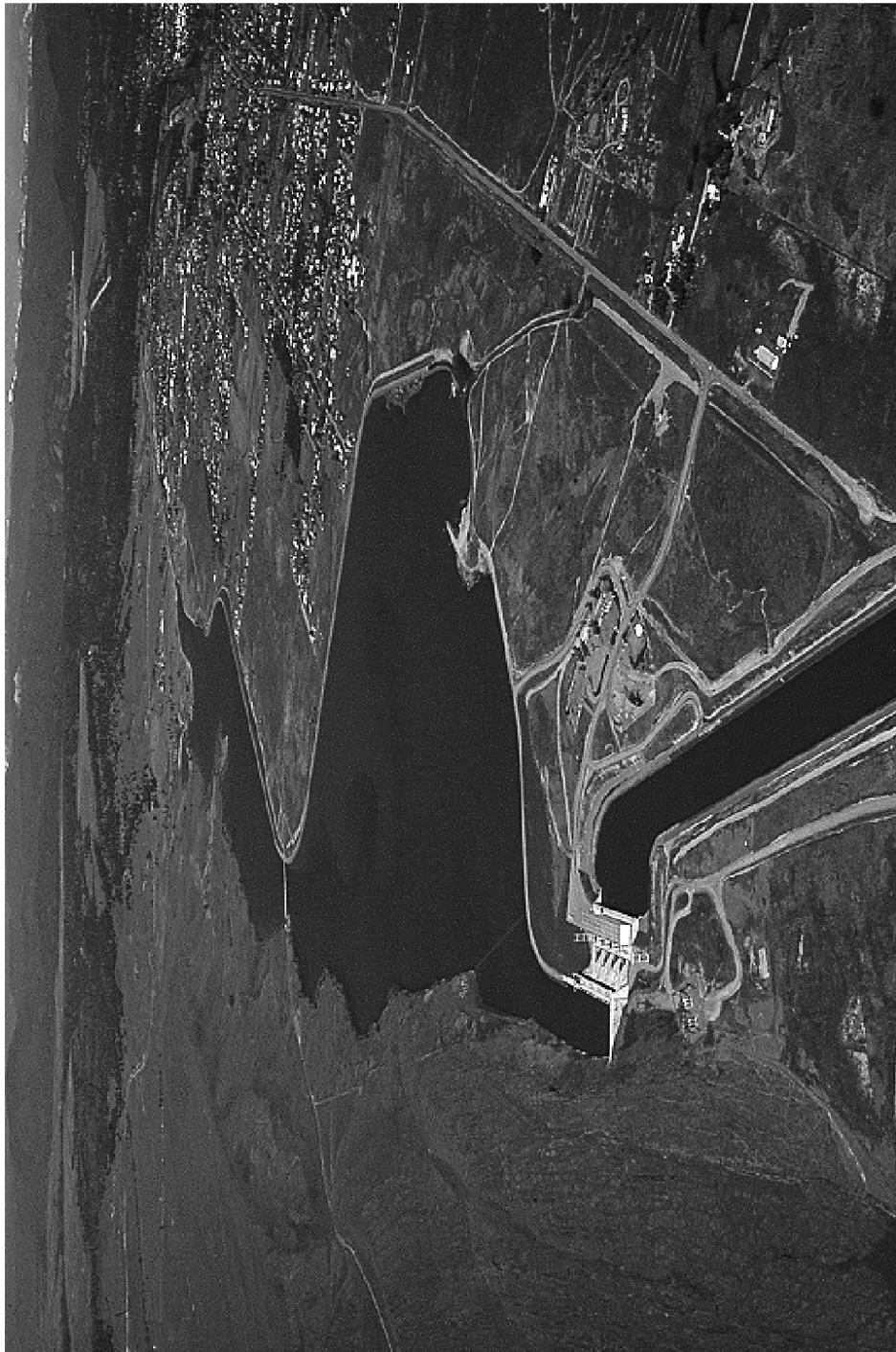
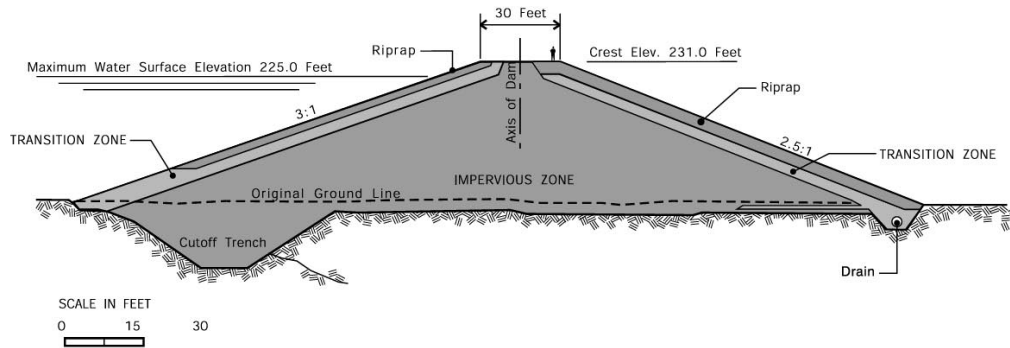
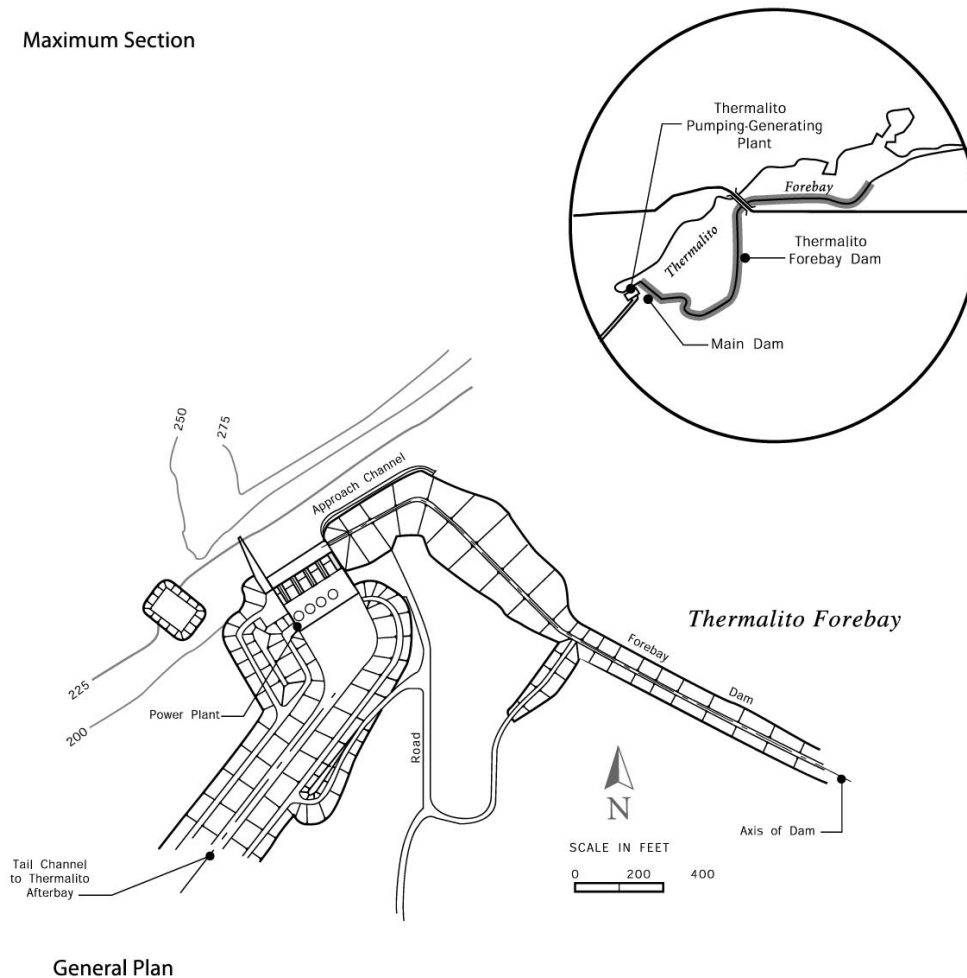


Figure 2-11 Thermalito Forebay, Forebay Dam
and Pumping-Generating Plant



Maximum Section



General Plan

Figure 2-12 Thermalito Forebay Dam

2.2.3.3 Thermalito Pumping-Generating Plant

The Thermalito Pumping-Generating Plant (Figures 2-11 and 2-13) was constructed from 1964-1969 with operations beginning in 1968. It is operated in tandem with the Edward Hyatt Powerplant to produce power during times of peak electric demand. Table 2-3 provides the pumping and generating information for the plant.

**Table 2-3: Pumping and Generating Information for
Thermalito Pumping-Generating Plant**

	Pumping	Generating
Installed Capacity	9,120 cfs & 120,000 hp	114 MW & 17,400 cfs
Normal Static Head	85-102 feet	85-102 feet
Design Dynamic Head	99 feet	95 feet
Number of Units	3 (pumping/generating)	4 (1 generating, 3 pumping/generating)
Unit Size	3,040 cfs & 40,000 hp	3 @ 28 mVA (p/g) & 4,200 cfs 1 @ 36 mVA (g) & 4,800 cfs
Penstock/ Diameter		1 @ 24 to 21 feet 3 @ 21 to 18 feet

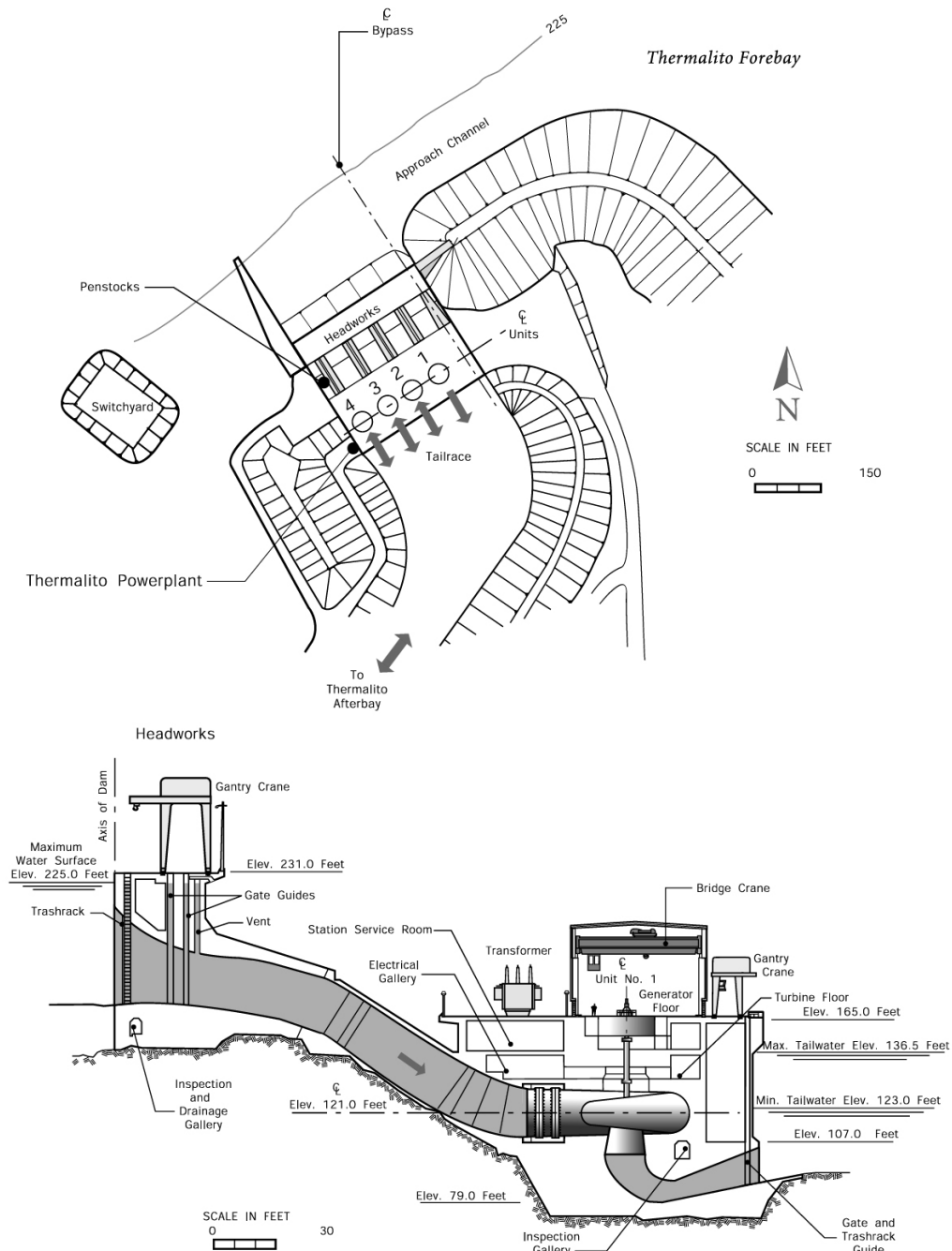


Figure 2-13 Thermalito Pumping-Generating Plant

2.2.4 Thermalito Afterbay

2.2.4.3 Thermalito Afterbay Dam

Thermalito Afterbay Dam (Figures 2-14, 2-15, and 2-16) is located about six miles southwest of the City of Oroville. The dam was constructed from 1965 – 1968. It is a homogeneous earthfill dam with the longest crest (42,000 feet) in the SWP system. It has an embankment volume of 5,020,000 cubic yards, a height of 39 feet and a crest elevation of 142 feet.

2.2.4.2 Thermalito Afterbay

The Thermalito Afterbay (Figures 2-14 and 2-15) has five purposes: (1) it provides storage for the water required by the pump-back operation to Lake Oroville; (2) it helps regulate the power system; (3) it produces controlled flow in the Feather River downstream from the Oroville Thermalito Facilities; (4) it provides recreational opportunities; and (5) it serves as a warming basin for agricultural water delivered to farms east of the afterbay.

The Thermalito Afterbay holds a maximum of 57,040 acre-feet of water. The water surface elevation and water surface area at maximum operating storage are 136.5 feet and 4,300 acres, respectively. The shoreline covers 26 miles at maximum operating storage.

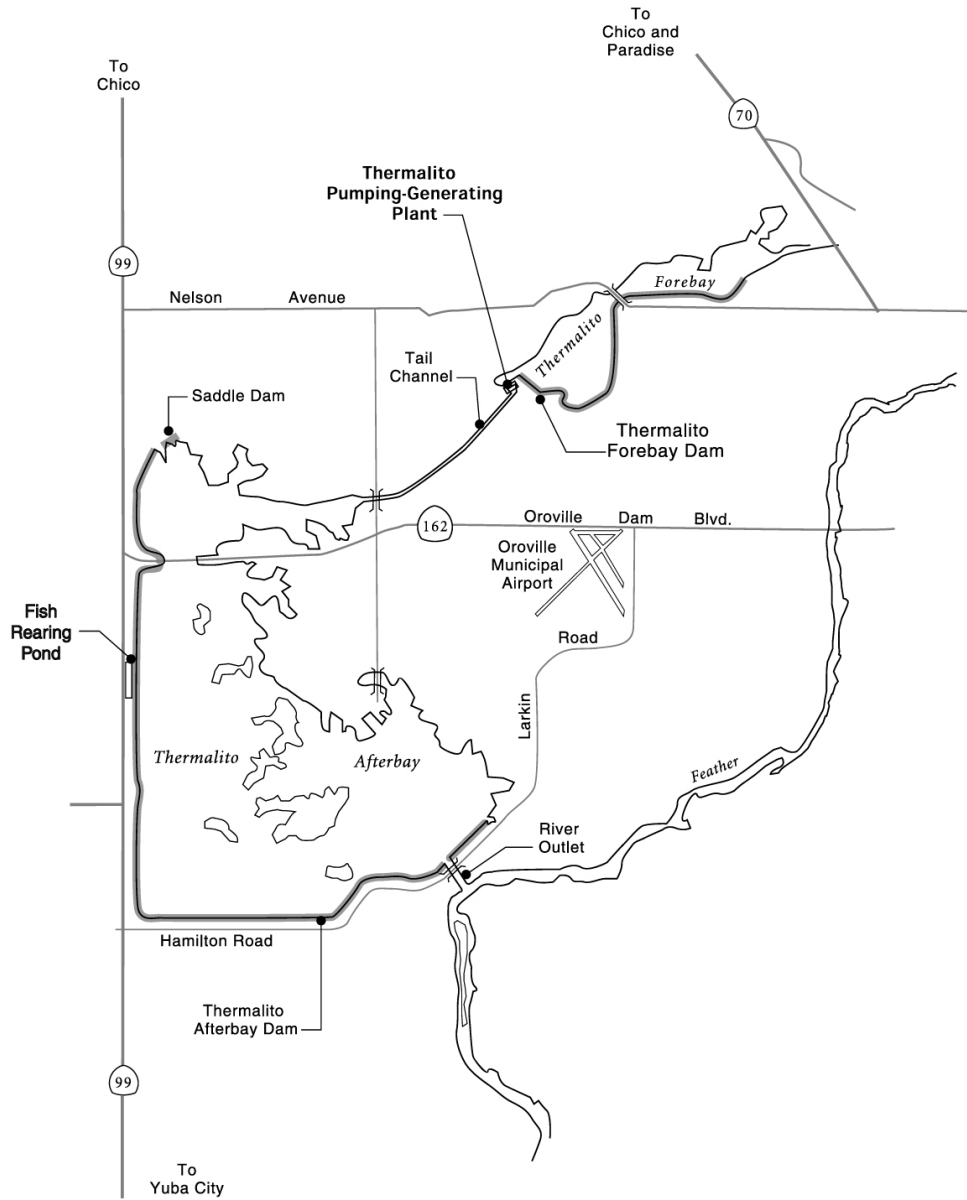
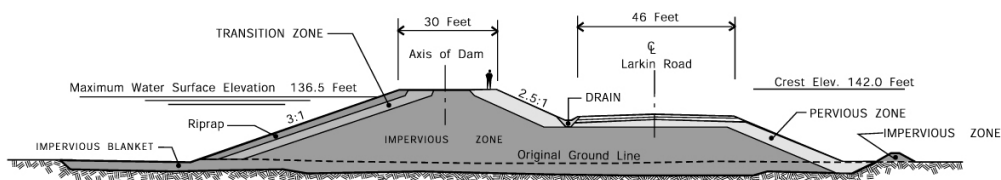


Figure 2-14 Thermalito Afterbay & Dam

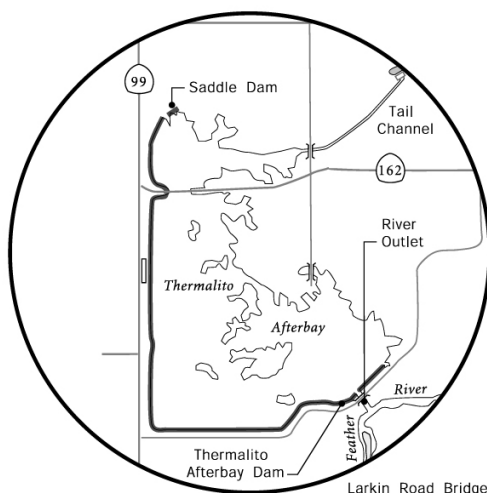


Figure 2-15 Thermalito Afterbay and Dam



Maximum Section

SCALE IN FEET
0 10 20



General Plan

SCALE IN FEET
0 600

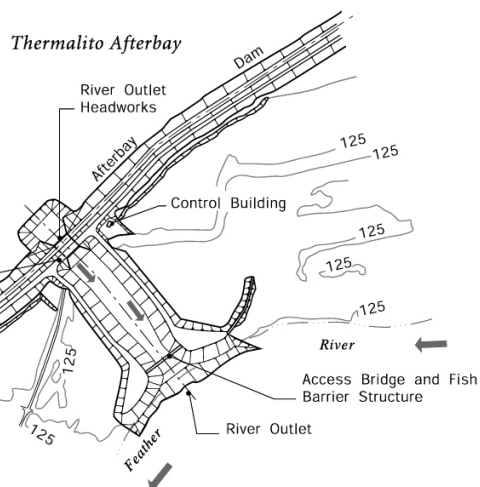


Figure 2-16 Thermalito Afterbay Dam

2.2.5 Fish Barrier Dam and Pool

2.2.5.1 Fish Barrier Dam

The Feather River Fish Barrier Dam (Figures 2-17 and 2-18) and Pool (Figure 2-17) are located upstream of the Feather River Fish Hatchery. They were constructed between 1962-1964. The dam diverts fish into a fish ladder that leads to the hatchery. The dam is a concrete gravity dam with a volume of 9,300 cubic yards. The height is 91 feet and the crest elevation and length are 181 feet and 600 feet, respectively.

2.2.5.2 Fish Barrier Pool

The Fish Barrier Pool has a storage capacity of 560 acre-feet and covers 50 acres. The shoreline covers one mile at gross capacity.

2.2.6 Feather River Fish Hatchery

The Feather River Fish Hatchery (Figure 2-19), completed in 1967, was built to compensate for spawning grounds lost to returning salmon and steelhead trout with the construction of Oroville Dam. The facility accommodates an average of 8,000 adult fish per year. Salmon and steelhead raised at the hatchery are transported in oxygenated, temperature-controlled tanks and released in the Feather and Sacramento rivers, in Lake Oroville and other California reservoirs, and in San Pablo Bay near San Francisco Bay. These fish account for an estimated 20 percent of the ocean sport and commercial catch of chinook salmon in the Pacific Ocean.

The facility is operated by the California Department of Fish and Game (DFG) and maintained by DWR.

2.2.6.1 Fish Ladder with Underwater Viewing Area

The fish barrier dam and pool, located upstream of the Feather River Fish Hatchery, divert fish into a fish ladder (Figure 2-20) that leads to the hatchery. The fish ladder is approximately $\frac{1}{2}$ mile long and consists of a series of “steps” and pools. Pool length ranges from 8 to 1,000 feet, with a minimum width of six feet and a minimum water depth of two feet. Velocity of flow in the ladder ranges from two to five feet per second (fps), and the maximum drop between pools is one foot. Underwater passage of fish can be observed through 42-inch square viewing panels installed in the fish ladder wall.



Figure 2-17 Feather River Fish Hatchery

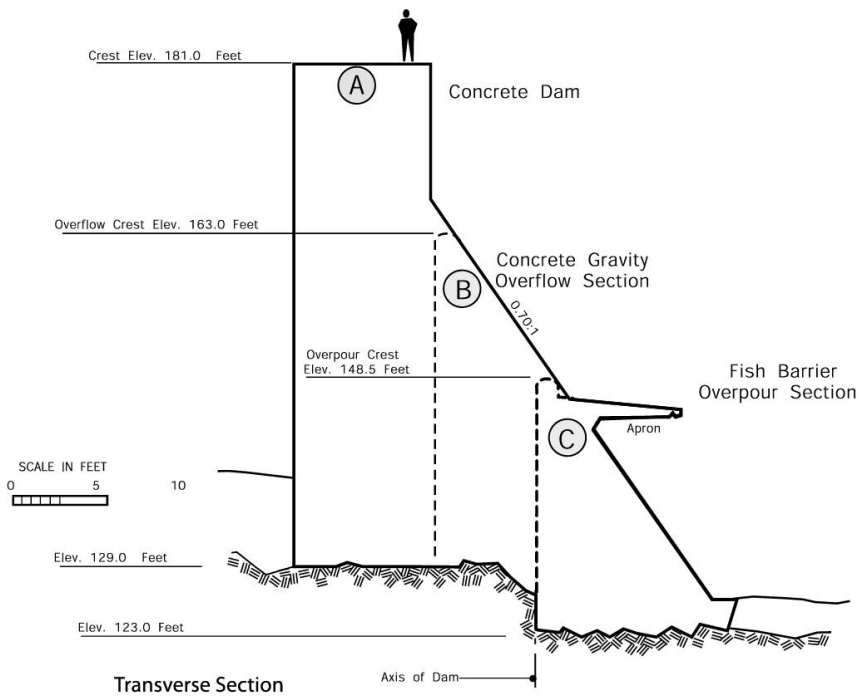
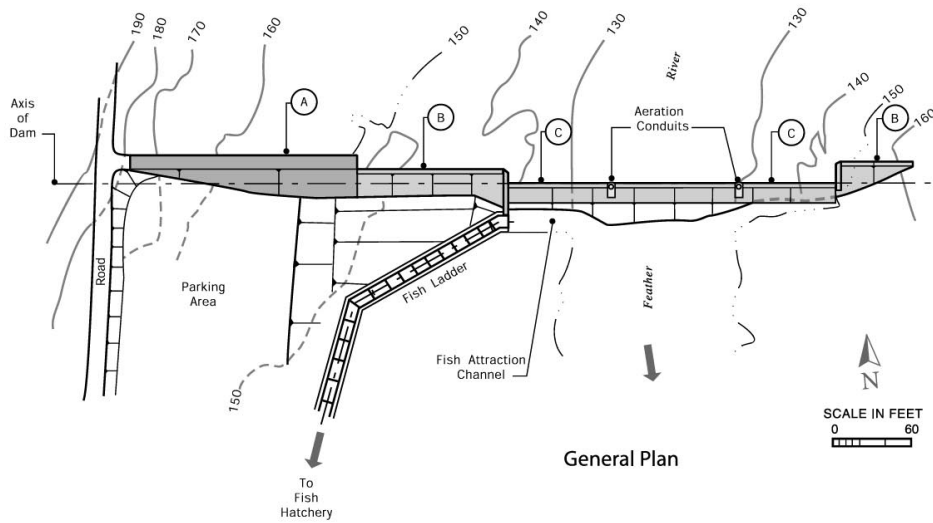
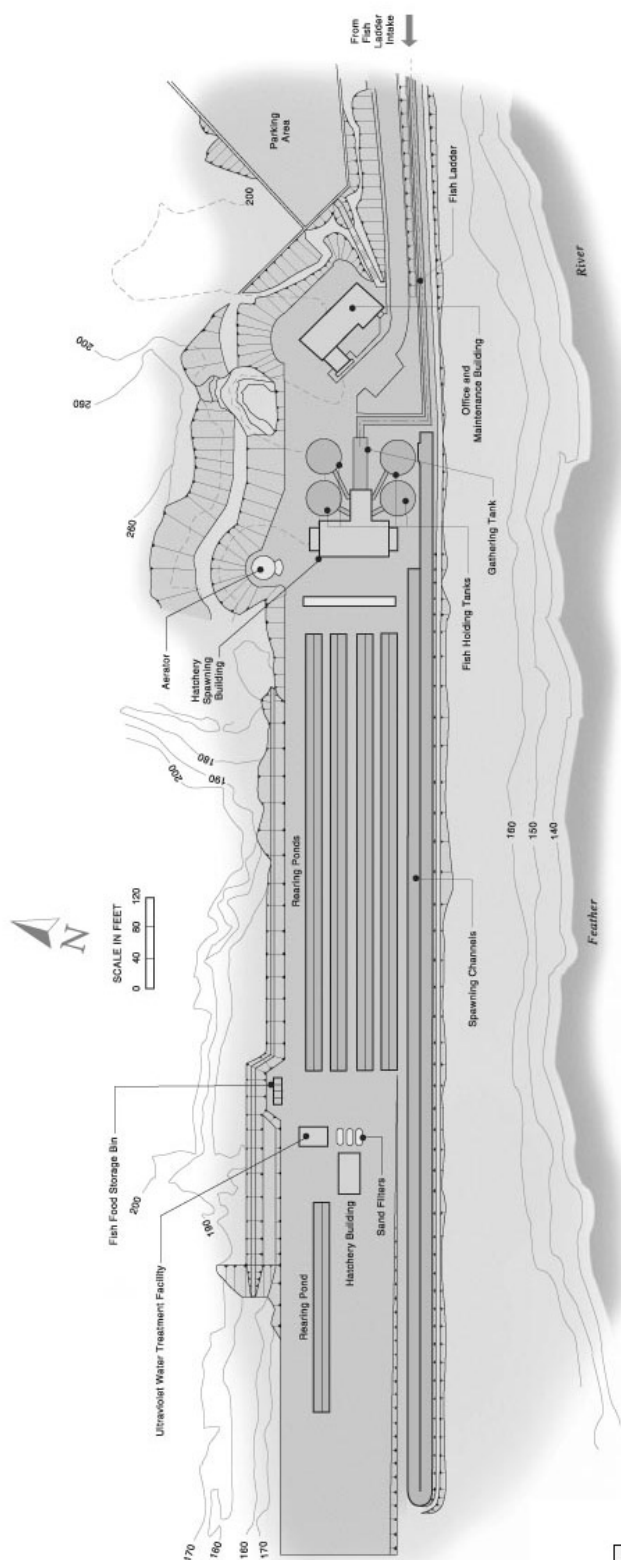


Figure 2-18 Oroville Fish Barrier Dam



General Plan of Fish Hatchery Facilities

Figure 2-19 Feather River Fish Hatchery

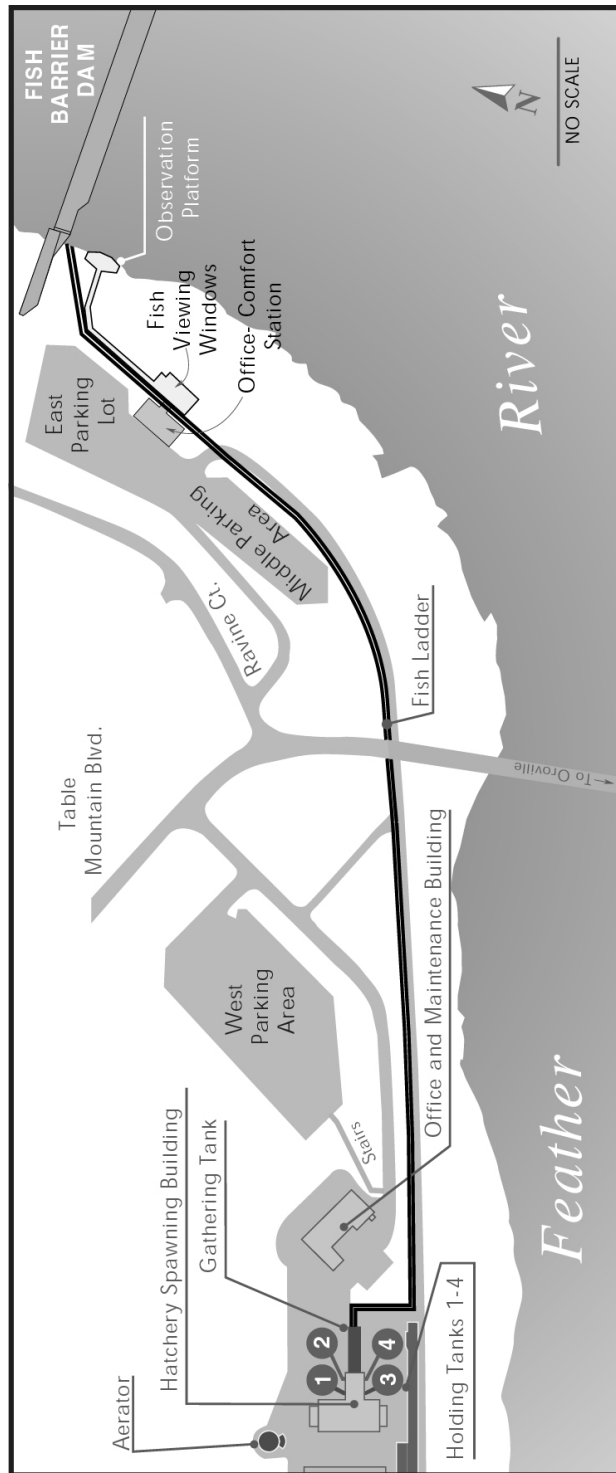


Figure 2-20 Location of Fish Ladder and Fish Viewing Area

An enlarged section of the fish ladder at its upstream terminus functions as a gathering tank, entrapping fish ascending the ladder. A mechanical sweep gathers the fish and deposits them into the abutting spawning building. Four concrete circular tanks hold the fish until they are ready to spawn.

2.2.6.2 Spawning-Hatchery Building

The spawning-hatchery building is where the artificial spawning takes place. Milt is taken from the male and mixed with eggs taken from the female. The eggs are kept in incubators capable of holding up to 25 million eggs.

The fry or young fish are held in incubators until they can be transferred to the rearing channels.

2.2.6.3 Rearing Channels

Young fish (fingerlings and yearlings) are held in rearing channels until they are ready for release. The rearing channels are concrete-lined raceways blocked off in intervals to form 48 individual pools 100 feet long and 10 feet wide. Water flow and velocity in the raceways are 3 to 5 cfs at 0.1 fps. The raceways are covered with netting to protect the fish from predators such as hawks and herons.

2.2.6.4 Thermalito Facility

Located on the west side of the Thermalito Afterbay, the Thermalito Facility is a set of fish rearing ponds (see Figure 2-14) used to raise salmon fry susceptible to the Sacramento River Chinook Disease (a coldwater virus) and young salmon. Its two rearing pond raceways can raise 2.5 million fingerlings for planting in San Pablo Bay or for study purposes.

2.3 TRANSMISSION LINES

There are no transmission lines associated with the Oroville Facilities.

2.4 PROPOSED CHANGES TO THE OROVILLE FACILITIES

At present, the DWR is not proposing any changes to the Oroville Facilities. However, changes to the design of the Oroville Facilities may occur as a result of the relicensing process.